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Original article

Management of staple line leaks following sleeve gastrectomy

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Abstract

Background: Leaks after laparoscopic sleeve gastrectomy (LSG) are not very frequent but are a difficult complication that can become chronic. Various treatment options have been suggested but no definitive treatment regimen has been established. The aim of our study is to report leak complications after LSG, their management, and outcomes.

Methods: Between June 2008 and October 2013, a total of 539 patients underwent laparoscopic and robot-assisted laparoscopic sleeve gastrectomy at our institution. A retrospective review of a prospectively collected database was performed for all LSG patients, noting the outcomes and complications of the procedure.

Results: Fifteen (2.8%) patients presented with a leak after LSG. The diagnosis was made at a mean of 27.2 ± 29.9 days (range, 1–102) after LSG. Eight (53.3%) patients underwent conservative treatment initially and 6 (75.0%) of these patients required stenting as secondary treatment. Although leaks from 3 patients resolved with stenting, the other 3 required restenting and 2 eventually underwent conversion to gastric bypass. Five (33.3%) patients underwent endoscopic intervention, closing the leak with fibrin glue (n = 3) or hemoclips (n = 2). Two (13.3%) patients who were diagnosed with a leak immediately after LSG before discharge had their leak oversewn laparoscopically with an omental patch. Leaks in 9 (60.0%) patients did not heal after the first intervention, and the mean number of intervention required was 2.3 ± 1.7 times (range, 1–7) for the treatment of this condition.

Conclusion: Management of leaks after LSG can be challenging. Early diagnosis and treatment is important in the management of a leak. However, it can be treated safely via various management options depending on the time of diagnosis and size of the leak. (Surg Obes Relat Dis 2015;11:54–59.) © 2015 American Society for Metabolic and Bariatric Surgery. All rights reserved.

Keywords: Staple line leak; Fistula; Complications; Sleeve gastrectomy; Reoperation; Stent; Fibrin glue; Hemoclip

Laparoscopic sleeve gastrectomy (LSG) was initially introduced as a first-step procedure followed by biliopancreatic diversion or duodenal switch in high-risk morbidly obese patients. However, early findings of LSG showed excellent weight loss as well as co-morbidity resolution, and LSG gained popularity as a primary restrictive bariatric procedure [1–3]. A recent report showed similar excess weight loss for Roux-en-Y gastric bypass (RYGB) and LSG at 12 months after adjusting for age and body mass index (BMI) [4].

Furthermore, LSG has drawn attention because of its technical simplicity and lower long-term complication rate compared with those of RYGB [1]. Overall complication rate after LSG was lower than that of adjustable gastric banding as well, ranging between 2–15% [5,6]. Major

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complications after LSG include leakage, bleeding, and stricture [7]. The incidence of significant staple line bleeding rate is reported to be 2% in average [3]. Staple line leaks are still of great concern and perhaps the most feared complication after LSG [5,8,9].

Leak rates are reported to be 1–7% in LSG patients and some surgeons have attempted to decrease this rate by oversewing the staple line or using a reinforcement material [10–14]. However, true effect of staple line reinforcement on leaks after LSG remains unclear at the moment [12,15,16]. Leaks have been reported to be related to the bougie size, narrower bougies resulting in higher incidences of leaks [3,17]. Chronic leaks are even more challenging to treat, as many have been persistent and recurrent [14,18]. The aim of our study is to report management and outcomes of staple line leaks after LSG at our institution.

Methods

After Institutional Review Board approval and the Health Insurance Portability and Accountability Act guidelines, the authors performed a retrospective chart review of a prospectively maintained database of 539 patients who underwent primary laparoscopic and robot-assisted LSG from June 4, 2008 to October 30, 2013. Patients who underwent LSG as a conversion, and patients with a previous bariatric procedure were not included in the present study. All procedures were performed by 2 surgeons according to the National Institutes of Health criteria for management of obesity.

Patients were included if they were diagnosed with a staple line leak after LSG. When patients complained of pain, nausea, or fever, either upper gastrointestinal imaging (UGI) or computed tomography (CT) scan of the chest, abdomen, and/or pelvis with contrast was performed.

Data points collected included demographic information, time to presentation from the original surgery, chief presenting symptoms, treatment method, and any readmissions for recurrence. All data for age and BMI are demonstrated as mean ± standard deviation, unless otherwise noted.

Surgical technique

Sleeve gastrectomy

A standard technique was used to perform sleeve gastrectomy. Using a harmonic scalpel, the greater omentum was detached from the greater curvature of the stomach about 3 cm from the pylorus all the way to the angle of His. The fundus of the stomach was separated from the retroperitoneum until the left crura was exposed. A 34 French bougie-sized Edlich tube (Covidien, Mansfield, MA) was inserted into the stomach along the lesser curvature to help calibrate the size of the sleeve. Multiple fires of an Echelon Endopath 45 and 60 (Ethicon Endo-surgery, Somerville, NJ) were then used to transect the stomach. The staple line was then oversewn using a 2-0 Polysorb stitch. The staple line was tested with air and methylene blue. A drain was placed, and the gastrectomy specimen was removed through the umbilical incision. The drain was typically left for 1–2 days and removed at discharge.

Out of 539 laparoscopic cases, 125 (23.2%) were done as robot-assisted laparoscopic procedures. Same harmonic scalpels were used as the energy source in robot-assisted cases by attaching them to the robot. Same laparoscopic linear staplers were used in the robotic cases as well. There were no technique differences between laparoscopic and robotic cases. Robotic cases were selected randomly, and no selection bias was present to patients with robotic approach. No robotic cases were converted to laparoscopic, and no procedure was converted to open.

Placement of stents

Stents were endoscopically placed. After identifying the leak site, a guide wire was placed under direct visualization and distal site of the leak was marked. One 23 × 100 mm and one 23 × 150 mm sized esophageal stents were anchored at the distal mark and deployed. Complete coverage was confirmed with the endoscope. Stents were typically left in place for 4 weeks unless migrated or were intolerable to the patient.

Conversion to Roux-en-Y gastric bypass

A 15–30 cc gastric pouch was created, resecting the leak site with a linear stapler. The staple line was oversewn with running and/or interrupted 2-0 Polysorb sutures. The ligament of Treitz was identified, the jejunum was transected with a linear stapler at 40 cm, and the mesentery was left intact. The efferent limb was followed for 75 cm, and jejunojejunostomy was performed using the linear stapler. The Roux limb was brought in as antecolic, antegastric fashion. After creating the gastrojejunostomy with the linear stapler, the staple lines were oversewn on the pouch.

Results

Out of 539 patients, 3 (0.6%) patients were lost to follow-up and thus excluded from the analysis. A total of 15 (2.8%) patients were identified to have a leak complication after LSG. Mean age was 39.5 ± 9.9 years (range, 22–55) and mean BMI was 48.5 ± 10.5 kg/m^2 (range, 37.6–77.2) at the time of LSG in these patients. Demographic characteristics of these patients are listed in Table 1. Of these, 5 patients were from the robotic-assisted group (n = 125) and 10 patients were from the laparoscopic group (n = 411). The leakage rate was 4.0% in the robot-assisted group and 2.4% in the laparoscopic group. All leaks were proximal and identified at the gastroesophageal junction.

Table 1
Demographic characteristics of patients who developed leak complication after sleeve gastrectomy

Characteristics	Patients
Male	2 (13.3%)
Female	13 (86.7%)
Age (yr)*	39.5 ± 9.9 (range, 22–55)
Body mass index (kg/m^2)*	48.5 ± 10.5 (range, 37.6–77.2)
Co-morbidities*	
Hypertension	4 (26.7%)
Diabetes mellitus	4 (26.7%)
Hyperlipidemia	5 (33.3%)
Sleep apnea	3 (20.0%)
Length of hospital stay (d)	2.0 ± 2.1 (range, 1–9)

*At the time of primary sleeve gastrectomy procedure.

No procedure-related death occurred during the period of follow-up.

Initial treatment

The diagnosis of leaks was made at a mean period of 27.2 ± 29.9 days (range, 1–102) after LSG, and the mean follow-up period was 12.6 ± 10.3 months (range, 1–30). Presenting symptoms were nausea and/or vomiting (n = 5), abdominal pain (n = 4), left shoulder pain (n = 3), and fever and/or chills (n = 2). One patient was diagnosed on postoperative day 1 after a routine UGI series without specific presenting symptoms.

The diagnosis was made by CT (n = 7), UGI (n = 5), upper endoscopy (n = 2), and diagnostic laparoscopy (n = 1). As initial interventions, 8 (53.3%) patients underwent conservative treatment including nothing by mouth, intravenous antibiotics, and total parenteral nutrition with (n = 5) or without (n = 3) CT-guided drainage. Five (33.3%) patients underwent endoscopic intervention, closing the leak with fibrin glue (n = 3) or hemoclips (n = 2). Two (13.3%) patients who were diagnosed with leaks immediately after LSG, before discharge, were sent back to the operating room. Both patients had their leaks laparoscopically oversewn with an omental patch. As drains were removed at discharge in our patients, no patient except these 2 had a drain still placed at the time of diagnosis.

Leaks in 9 (60.0%) patients did not heal after the first intervention, and the mean number of interventions required was 2.3 ± 1.7 times (range, 1–7) for treatment of this condition.

Outcomes of initial interventions

Of the 8 patients who underwent conservative treatment, one (12.5%) leak was resolved. Six (75.0%) patients underwent stent placement via endoscopy with or without pyloric dilation as secondary interventions. One (12.5%) patient underwent a reoperation as she continued to have fever and chills and the CT showed biliary air. She had laparoscopic drainage of the subphrenic abscess, and the leak was oversewn with an omental patch.

Among 5 patients with endoscopic intervention, 4 (80.0%) had resolution of leaks. One patient who had her leak closed with fibrin glue had a hemoclip placed endoscopically because of a persistent leak with diameter of 5–7 mm 8 months later. However, this patient continued to have a leak and eventually had laparoscopic reconstruction of the Roux limb to drain the leak 29 months after the initial LSG. Her leak resolved after the reoperation.

Both leaks of the 2 patients who were reoperated in the immediate postoperative period were closed and did not require further treatment.

Outcomes of stent placement as secondary interventions

Of 6 patients who underwent endoscopic stent placement, 3 (50.0%) showed resolution of leaks and had their stents removed. One stent migrated into the stomach and attempts to remove it endoscopically failed. This patient was sent to the operating room for laparoscopy-assisted endoscopic removal of the stent, which also failed, and the stent was removed laparoscopically via gastrotomy.

Three (50.0%) other patients required restenting because of intolerance or migration. Of these patients, 1 patient had her leak resolved after restenting. Two patients were eventually converted to RYGB because of a persistent leak 1 month and 4 months after LSG. These 2 patients had their leaks resolved after conversion, but 1 patient presented with a ruptured staple line of the gastric remnant and peritonitis 3 weeks after the conversion. Of note, she had her stent removal and conversion to RYGB on the same day. She required multiple exploratory laparotomies and a splenectomy because of abscesses and a chronic pancreatocutaneous fistula.

The flowchart of these interventions stratified by the time of appearance using Rosenthal's classification [1] is shown in Table 2.

Discussion

The number of LSG performed worldwide has increased dramatically in the recent years [19]. Advantages of LSG include excellent weight loss outcomes, co-morbidity resolutions, relative ease of the technique, avoidance of foreign bodies or adjustments, shortened operating time, and immediate restriction of caloric intake [1,6]. Fridman et al. [20] recently reported that reoperation and procedure-related morbidity rates were the lowest for LSG compared with those of laparoscopic RYGB and adjustable gastric banding. Despite the low morbidity rate, some complications after LSG have been challenging to manage. Staple line leakage is one of these complications, which can become chronic, recurrent, and require multiple interventions [18]. Leaks are known to most frequently occur at the

Table 2
Treatment outcomes of sleeve gastrectomy patients with a leak

1st Interv	Outcome	2nd Interv	Outcome	3rd Interv	Outcome	4th Interv	Outcome
Acute leak (within 7 d) n = 3							
Oversewn (2)	Resolved (2)						
Drainage (1)	High output (1)	Stent (1)	Migration (1)	2nd stent (1)	Resolved (1)		
Early leak (within 1–6 wk) n = 9							
Drainage (3)	High output (3)	Stent (3)	Resolved (2)				
			Leak (1)	2nd stent (1)	Leak (1)	RYGB (1)	Resolved (1)
Antibiotics (2)	Resolved (1)						
	Biliary air (1)	Oversewn (1)	Leak (1)	Hemoclip (1)	Resolved (1)		
Hemoclip/glue (3)	Resolved (3)						
Late leak (after 6 wk) n = 3							
Glue (2)	Resolved (1)						
	Leak (1)	Hemoclip (1)	Leak (1)	Roux limb reconstruction (1)	Resolved (1)		
Stent (1)	Intolerance (1)	2nd stent (1)	Resolved (1)				
Chronic leak (after 12 wk) n = 1							
Drainage (1)	High output (1)	Stent (1)	Intolerance (1)	2 nd stent (1)	Intolerance (1)	RYGB (1)	Ruptured staple line (1)

Interv = intervention; RYGB = Roux-en-Y gastric bypass; Oversewn = oversewing of the leak with omental patch.
Numbers in the parenthesis represent number of patients.

gastroesophageal (GE) junction in LSG patients [21,22]. Our findings coincided with these reports, as all our leaks occurred at the GE junction. Leak rates after LSG have been quoted to be between .7% and 2.4% [1,8,23], and a recent meta-review by Parikh et al. [24] reported a rate of 2.2%. Our leak rate was a little higher at 2.8%, which may have been because of the introduction and learning curve of robotic LSG. Robot-assisted LSG was implemented into our practice since June 2012, and we did not exclude patients during the learning curve period. Four (26.7%) of our 15 leak complications occurred in the initial 60 robot-assisted cases.

Some surgeons have attempted to reduce the leak rate by oversewing or buttressing the staple line. D'Ugo et al. [15] reported that staple line reinforcement with bovine pericardium strips significantly reduced the risk of leakage. Aggarwal et al. [12] suggested that oversewing the staple line may lead to reduction in leak rate. In our study, all staple lines were buttressed with Surgicel Nu-knit (Johnson and Johnson, Somerville, NJ, USA) for hemostasis [25]. Staple lines were then oversewn with absorbable sutures over a 34Fr sized bougie.

It is also a consensus that the incidence of leaks is higher when the bougie size is smaller and the sleeve is tighter [1]. Gagner [17] demonstrated an inverse logarithmic relationship between the bougie size and the percentage of leak rate after LSG. In this article, a bougie size of 60Fr and above was associated with a much lower risk of leaks than that of 40Fr and less. However, Rosenthal et al. [1] reported that the optimal bougie size is 32–36Fr, and a 34Fr bougie was used in the present study.

Rosenthal et al. [1] categorized the leak into acute (within 7 d), early (within 1–6 wk), late (after 6 wk), and chronic (after 12 wk) according to the time of presentation after the primary procedure. Our 2 patients who were diagnosed with a leak before discharge were both taken back to the operating room and had their leaks laparoscopically oversewn with an omental patch. These patients were placed into the category of an acute leak, and their leaks healed without recurrence. One patient was diagnosed 6 days after LSG (acute), but was treated with antibiotics as she had already been discharged and the leak site may have been contaminated. She continued to have a high drain output, and a stent was placed 8 days later. She required a second stent because of migration of the first stent. Her leak resolved with the second stent.

Rosenthal et al. [1] also suggested that after 30 days the likelihood of a leak to seal by only using a stent was very low. Our 3 patients who had their leaks resolved with a stent placement all had their stents placed within 30 days after LSG. Two patients, who underwent conversion to RYGB after failed stent intervention, initially had their stents placed 12 and 118 days after LSG. One of these 2 patients required multiple exploratory laparotomies and a splenectomy because of abscesses and a chronic pancreato-cutaneous fistula. We would like to note that this patient had the stent removal and conversion to RYGB on the same day and had a ruptured staple line of the gastric remnant 3 weeks later. As noted in the surgical technique, staple lines of the pouch were oversewn, but the gastric remnant was not. It was suggested in the literature that the surgeon should wait a minimum of 12 weeks after conservative therapy to allow the body to heal and avoid thick adhesions during reoperation before reoperating to repair a proximal leak [1]. We postulate that the tissue was edematous after stent removal and should have waited at least 7 days for conversion to RYGB. We would also like to note that 2 of our 6 stent patients showed intolerance to stents, and 1 patient had migration of the stent.

Data is limited in the current literature regarding hemoclips and fibrin glue for leaks after LSG. Some have reported poor success with endoscopic clip placement in leaks that do not heal after several weeks [26,27]. Some have advocated the use of fibrin glue injection to the leak site [26]. In the present study, 4 (80.0%) out of 5 patients treated with hemoclip or fibrin glue had their leaks resolved. Of note, all 3 early leak patients were successfully managed with clip or glue, and 1 patient who failed with this management was in the late leak category. We used this method for small leaks (<1 cm), and this may account for the excellent resolution rate. One patient without resolution underwent laparoscopic reconstruction of the Roux limb to drain the leak 29 months after LSG and her chronic leak resolved. Chouillard et al. [28] demonstrated Roux-en-Y fistula-jejunostomy to be a safe and feasible salvage procedure for the treatment of patients with post-LSG fistula. We also think it is a good option for chronic leaks, as the use of Roux limb allows less tension on the gastrojejunal anastomosis.

The small sample size, no randomization, and the varying techniques of the original procedure (laparoscopic versus robotic) all add to the limitations of this study. However, this is one of few reports on management of sleeve leaks. Several options are available depending on the time of diagnosis and size of the leak. If the leak presents before discharge, usually within 3 days of the original surgery, we recommend reoperation with wound washout and suture repair of the leak. For late leaks, a more conservative approach should be undertaken. If the leak is small, <1 cm, then a trial of hemoclips or fibrin glue should be attempted. Failure of resolution or larger leaks should prompt the placement of an endoluminal stent. Continued leaks should prompt an assessment for possible conversion to a RYGB.

Conclusion

Management of leaks after LSG can be challenging. Early diagnosis and treatment is important in the successful management of leaks. However, leaks can be managed safely via varying management options depending on the time of diagnosis and size of the leak.

Disclosures

The authors have no commercial associations that might be a conflict of interest in relation to this article.

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